PATENT ABSTRACTS OF JAPAN

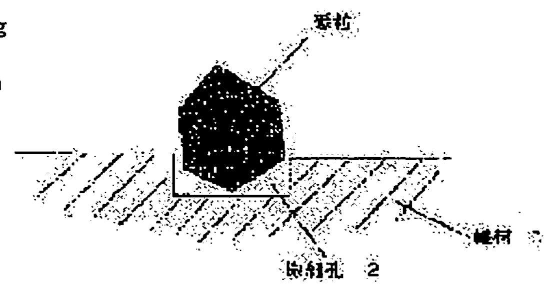
(11)Publication number : 2001-232570
(43)Date of publication of application : 28.08.2001

(51)Int.CI.	B24D 3/06 B24D 3/00

(21)Application number : 2000-095866	(71)Applicant : WORLD METAL:KK
(22)Date of filing : 23.02.2000	(72)Inventor : HAYASHIDA HIDENORI

(54) ELECTRODEPOSITION TOOL AND MANUFACTURING METHOD THEREOF

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a holding and fixing structure for abrasive of an electrodeposition tool preventing the drop of abrasive and having excellent durability and a manufacturing method therefor.
SOLUTION: In this electrodeposition tool composed of a structure in which abrasives adhere on a surface of a tool shaft member and are held and fixed by an electrodeposited metal, minute holes having a depth less than a particle diameter of the abrasive and such hole diameter that allows one abrasive to be fitted therein are formed on the surface of the shaft member at equal distribution density (number/mm2), and the abrasive is fitted in the minute hole to electrodeposit and fix it.



LEGAL STATUS

[Date of request for examination]	26.02.2002
[Date of sending the examiner's decision of rejection]	
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]	
[Date of final disposal for application]	
[Patent number]	
[Date of registration]	
[Number of appeal against examiner's decision of rejection]	
[Date of requesting appeal against examiner's decision of rejection]	
[Date of extinction of right]	

(19)日本国特許庁（ＪＰ）　(12)**公開特許公報**（Ａ）　(11)特許出願公開番号

特開2001－232570

（Ｐ２００１－２３２５７０Ａ）

(43)公開日　平成13年8月28日(2001.8.28)

(51)Int.Cl.⁷		識別記号	FI			テーマコード゛（参考）
Ｂ２４Ｄ	3/06		Ｂ２４Ｄ 3/06		Ｂ	3C063
	3/00	３４０	3/00	３４０		

審査請求　未請求　請求項の数３　書面（全　４　頁）

(21)出願番号　特願2000－95866(P2000－95866)

(22)出願日　平成12年2月23日(2000.2.23)

(71)出願人　000139333
株式会社ワールドメタル
大阪府東大阪市今米2丁目1番29号

(72)発明者　林田　英穂
東大阪市今米2丁目1番29号株式会社ワールドメタル内

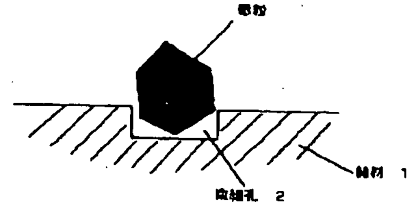
Fターム（参考）　3C063 AA02 AB02 AB07 BB02 BB23 BB24 BC02 BG30 CC13 CC16 EE10 FF22 FF23

(54)【発明の名称】電着工具とその製造方法

(57)【要約】

【課題】砥粒が脱落し難く、耐久性に優れた電着工具の砥粒の保持固定構造とその製造方法に係る。

【解決方法】工具軸材の表面に砥粒を付着させ、電着金属で保持固定した構造からなる電着工具において、該軸材表面に、該砥粒の粒径未満の深さを持ち、砥粒一個が嵌入できる孔径を持つ微細孔を、均等な分布密度（個数／mm２）で形成し、該微細孔に該砥粒を嵌入して電着固定してなることを特徴とする。



【特許請求の範囲】
【請求項１】工具軸材の表面に砥粒を付着させ、電着金属で保持固定した構造からなる電着工具において、該軸材表面に、該砥粒を単一層、均等な分布密度（個数／ｍｍ２）で電着固定してなることを特徴とする電着工具。
【請求項２】工具軸材の表面に砥粒を付着させ、電着金属で保持固定した構造からなる電着工具において、該軸材表面に、該砥粒の粒径未満の深さを持ち、砥粒一個が嵌入できる孔径を持つ微細孔を、均等な分布密度（個数／ｍｍ２）で形成し、該微細孔に該砥粒を嵌入して電着固定してなることを特徴とする電着工具。
【請求項３】砥粒一個が嵌入できる孔径を持つ微細貫通孔が均等な分布密度（個数／ｍｍ２）で分布するレジスト皮膜を工具軸材の表面に被覆する工程と、該レジストの微細孔に砥粒を嵌入して電着金属で仮付けする工程と、該レジスト膜を剥離して該砥粒を電着固定する工程を備えてなることを特徴とする電着工具の製造方法.
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、工具軸材の周りに、砥粒が単一層、均等な分散密度で分布する電着工具の構造と、その製造方法に係るものである。
【０００２】
【従来の技術】電着工具とは、軸材の周りに付着させた砥粒を電着金属で軸材の周りに埋めて固定したものである。砥粒は一個一個が独立して均等な分布密度で分散していることが望ましいが、現実の電着工具では、砥粒が団子のように複数個重なり合ったり、粒子の上に更に粒子が載った状態で電着されている部分もある。これらの部分は研削加工中、粒子が脱落して遊離し、加工材料を傷つける結果を招く。昨今、厳しい加工品質が要求されるようになり、砥粒の脱落による傷の発生は許されなくなってきた。
【０００３】
【発明が解決しようとする課題】本発明はかかる問題に鑑みてなされたもので、砥粒が軸材表面に単一層、均等な分散密度で分布する新規な電着工具の構造と、その製造方法を提供せんとするものである。
【０００４】
【課題を解決するための手段】上記課題は次の手段によって解決できる。すなわち、
①工具軸材の表面に砥粒を付着させ、電着金属で保持固定した構造からなる電着工具において、該軸材表面に、該砥粒を単一層、均等な分布密度（個数／ｍｍ２）で電着固定してなることを特徴とする電着工具。
②工具軸材の表面に砥粒を付着させ、電着金属で保持固定した構造からなる電着工具において、該軸材表面に、該砥粒の粒径未満の深さを持ち、砥粒一個が嵌入できる孔径を持つ微細孔を、均等な分布密度（個数／ｍｍ２）で形成し、該微細孔に該砥粒を嵌入して電着固定してなることを特徴とする電着工具。
③砥粒一個が嵌入できる孔径を持つ微細貫通孔が均等な分布密度（個数／ｍｍ２）で分布するレジスト皮膜を工具軸材の表面に被覆する工程と、該レジストの微細孔に砥粒を嵌入して電着金属で仮付けする工程と、該レジスト膜を剥離して該砥粒を電着固定する工程を備えてなることを特徴とする電着工具の製造方法。
【０００５】
【発明の実施の形態】本発明電着工具の砥粒は、一個一個の粒子が単独、かつ均等な分布密度で分散し、一個一個が単独で電着固定されているのが特徴である。
【０００６】図１～５は本発明砥粒の分散構造を説明した模式図である。図１～２は軸材に微細孔を穿孔して分散させる構造を説明した模式図である。微細孔２の分布状態は、例えば図２のような規則的模様で穿孔する。微細孔２の大きさは、砥粒一個が嵌入できる直径で、かつ砥粒を嵌入した時、砥粒の先端が孔の外に突出る深さ、つまり、粒径未満の深さに穿孔する。図１はこの状況を説明した図である。穿孔の手段は、レーザー、ブラスト、エッチング等の機械的、化学的な方法を適宜採用できる。穿孔の手段は、上記した条件の孔を穿孔できる手段であれば、いかなる手段でも良い。次に孔に砥粒を嵌入して、種付け用の電着を行って砥粒を仮付けする。仮付け後、孔に嵌入した砥粒以外の余分の砥粒を洗浄、あるいは刷毛等で除去した後、砥粒を固定するための肉盛用電着を行う。
【０００７】図３～４は、軸材にレジスト膜を被覆し、このレジスト膜に形成した微細孔に砥粒を嵌入する方法を説明した模式図である。この方法は、先ず図３に示すように、軸材１にレジスト膜３を被覆し、レジスト膜にレーザーあるいはホトリソグラフィー等の方法を使って砥粒を嵌入する孔を穿孔する。孔の大きさは、図１，２の場合と同じく、砥粒一個が嵌入できる直径で、かつ、粒径未満の深さである。次にレジスト孔に砥粒を嵌入して、種付け用の電着を行って砥粒を仮付けする。仮付け後、レジストを除去する。図５は、レジストを除去した時の状況を説明した図である。次に砥粒を固定するための肉盛用電着を行う。
【０００８】肉盛用電着の厚さは、用途によって異なるが、概ね砥粒の粒径の半分以上が埋没する厚さが好ましい。
【０００９】肉盛電着の前に、軸材、砥粒の表面に無電解メッキ膜を０．００１～５０μｍ被覆しておくと、砥粒と肉盛金属の間に隙間が無くなり接触面積が大きくなると共に、砥粒の凹凸面全面にメッキ金属が入りこみ強力なアンカー効果が発現されることにより、砥粒の脱落がなくなり耐久性が大幅に向上する。無電解メッキは、Ｎｉ系，Ｃｏ系、Ｃｕ系が好ましく、とりわけ、Ｎｉ－Ｐ，Ｎｉ－Ｂ系メッキが好適である。メッキ厚は、砥粒と肉盛金属の間に隙間をなくすためには、メッキ厚さは

0．001μm以上必要である。またメッキ厚が上限を越えると加工中にメッキ膜に亀裂が発生して砥粒が脱落することがあり好ましくない。

【0010】電着砥粒は、ダイヤモンド、BN，SiC，WC，SiO2，グラファイト、SiN，SiC−Cu，SiC−Al，その他全ての砥粒を粒度を問わず使用できる。

【0011】種付け、および肉盛用電着金属は、ニッケル、コバルト、銅、鉄系金属等を適宜使用できるが、最も好ましいのは、ニッケル系金属である。

【0012】

【実施例】実施例1（CMP用ダイヤモンド電着工具）

軸材：SUS304ステンレス鋼、直径120mmの円板状軸材

図6は、軸材の断面図である。

砥粒：粒度　100メッシュのダイヤモンド砥粒

図7に示す分布模様で、軸材に、縦100×横50μm、深さ50μm、孔間の距離50μmで砥粒を嵌入する孔を穿孔した。

【0013】軸材を脱脂、酸洗い、ストライクNiメッキした後、軸材のAおよびA′表面にダイヤモンド砥粒を載せて、下記組成のNiメッキ液で0．2A／dm2の電流密度で、120分、種付けメッキした。

種付けメッキ液の組成

硫酸ニッケル240g／l，塩化ニッケル40g／l、ホウ酸40g／l，PH4．2、浴温55℃。

【0014】次に、ダイヤモンド砥粒を種付けした軸材をメッキ液から引き上げ、余分に付着したダイヤモンド、つまり凹孔以外に付着した砥粒を硬めの刷毛でこすり落とし、ダイヤモンドの付着状況を顕微鏡で観察した。凹孔全てにダイヤモンド砥粒が入りこみ、電着Niで固定されていた。

【0015】次に下記組成の肉盛メッキ液で1A／dm2の電流密度で60分肉盛メッキして砥粒の周りにNiを肉盛して、粒径の約80％を埋めこんだ。

肉盛用電気メッキ液の組成

硫酸ニッケル240g／l，塩化ニッケル45g／l、ホウ酸40g／l，応力減少剤（ワールドメタル社製：ゼロオール）20ml／l、PH4．2、浴温55℃

【0016】評価テスト

直径8インチのシリコンウエハーの研磨に使用して性能を評価した。1000枚まで、砥粒が脱落して傷が発生することも無く均一に研磨できた。一方、従来製法で作った同じ工具を使用して研磨テストした所、120枚でダイヤモンド砥粒が脱落して傷が発生した。本発明の工具は、砥粒脱落による傷の発生防止と耐久性の改善に顕著な効果があることを確認できた。

【0017】実施例2（CMP用ダイヤモンド電着工具）

実施例1と同じ軸材を使用した。

砥粒：実施例1と同じ粒度（100メッシュ）のダイヤモンド砥粒を使用した。軸材の砥粒電着表面（図6のAおよびA′面）にホトレジストを50μm塗布し、図7に示す分布模様の部分のみレジストを除去する方法で、軸材まで貫通する微細孔（縦100×横50μm、深さ50μm、孔間の距離50μm）を穿孔した。

【0018】レジストおよび微細孔の中の軸材の露出表面を脱脂、酸洗い、ストライクNiメッキした後、レジストを塗布したAおよびA′表面にダイヤモンド砥粒を載せて、実施例1と同じ組成のNiメッキ液で0．2A／dm2の電流密度で、120分、種付けメッキした。

【0019】次に、ダイヤモンド砥粒を種付けした軸材をメッキ液から引き上げ、余分に付着したダイヤモンド、つまり凹孔以外に付着した砥粒を硬めの刷毛でこすり落とし、更にレジストを溶剤で除去し、ダイヤモンドの付着状況を顕微鏡で観察した。一個一個の砥粒は、図7に示す分布模様で分布し、電着Niで固定されていた。

【0020】次に実施例1と同じ組成の肉盛メッキ液で1A／dm2の電流密度で60分肉盛メッキして砥粒の周りにNiを肉盛して、約80％を埋めこんだ。

【0021】評価テスト

直径8インチのシリコンウエハーの研磨に使用して性能を評価した。1200枚まで、砥粒が脱落することなく、均一に研磨できた。本発明の工具は、砥粒の脱落防止と耐久性の改善に著効があることを確認できた。

【0022】実施例3（無電解メッキを併用する実施例）

軸材、砥粒は実施例2と同じ。砥粒の種付け、レジスト剥離工程まで実施例2と同じ条件で実施。種付けした砥粒全面、および軸材AおよびA′面の露出した表面を、公知の方法で脱脂、センシタイザー、アクチベーター処理した後、下記組成の無電解メッキ液を使用してNi−Pを0．05μm無電解メッキした。

無電解Ni−Pメッキ液の組成

硫酸ニッケル　20g／l，クエン酸ナトリウム30g／l，次亜燐酸ナトリウム15g／l，PH8．9，40℃

次に実施例1と同じ組成の肉盛メッキ液で1A／dm2の電流密度で60分肉盛メッキして砥粒の周りにNiを肉盛して、約80％を埋めこんだ。

【0023】評価テスト

直径8インチのシリコンウエハーの研磨に使用して性能を評価した。1500枚まで、砥粒が脱落することなく、均一に研磨できた。無電解メッキの併用は、砥粒の脱落防止と耐久性の改善に著しい効果があることを確認できた。

【0024】

【発明の効果】以上詳記したように、本発明は電着工具の砥粒の脱落防止に顕著な効果を有し、工具の耐久性と

加工品質の向上に多大の貢献をなすものである。

【図面の簡単な説明】

【図1】図1は本発明工具の砥粒を微細孔に嵌入して分散させる構造を説明した図である。

【図2】図2は図1の分散状態を説明した図である。

【図3】図3はレジスト孔の説明図である。

【図4】図4はレジストの孔に砥粒を嵌入した状態の説明図。

【図5】図5はレジストを除去した状態の説明図である。

【図6】図6は実施例の軸材の断面図である。

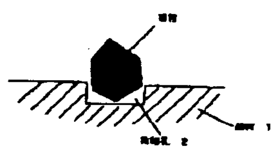
【図7】図7は実施例の砥粒の分散状態の説明図である。

【符号の説明】

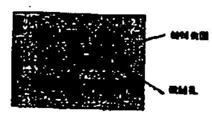
1…軸材　　2…微細孔

3…レジスト膜

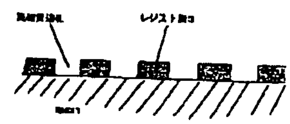
【図1】



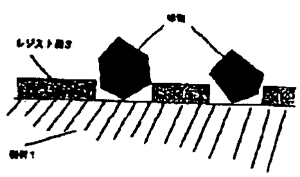
【図2】



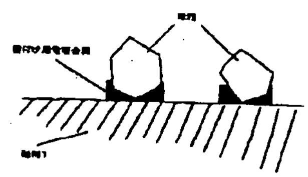
【図3】



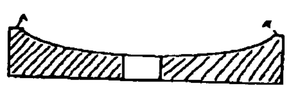
【図4】



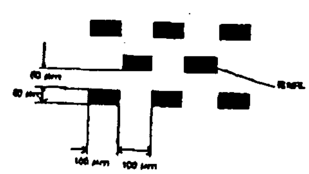
【図5】



【図6】



【図7】



CLAIMS

[Claim(s)]
[Claim 1] The electrodeposted tool characterized by coming to carry out electrodeposted immobilization of this abrasive grain by the monolayer and equal distribution density (number/mm of pieces 2) on this shaft material front face in the electrodeposted tool which consists of structure which the abrasive grain was made to adhere to the front face of tool shaft material, and carried out maintenance immobilization with the electro-deposited metal.
[Claim 2] The electrodeposted tool characterized by making an abrasive grain adhere to the front face of tool shaft material, having the depth of under the particle size of this abrasive grain in this shaft material front face, forming micropore with the aperture which can insert an abrasive grain piece by equal distribution density (number/mm of pieces 2) in the electrodeposted tool which consists of structure which carried out maintenance immobilization with the electro-deposited metal, inserting this abrasive grain in this micropore, and coming to carry out electrodeposted immobilization.
[Claim 3] The manufacture approach of the electrodeposted tool characterized by coming to have the process which covers the resist coat over which a detailed through tube with the aperture which can insert an abrasive grain piece is distributed by equal distribution density (number/mm of pieces 2) on the front face of tool shaft material, the process which inserts an abrasive grain in the micropore of this resist, and carries out temporary attachment with an electro-deposited metal, and the process which exfoliates this resist film and carries out electrodeposted immobilization of this abrasive grain.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the structure and its manufacture approach of the electrodeposted tool by which an abrasive grain is distributed over the surroundings of tool shaft material by the monolayer and the equal distributed consistency.
[0002]
[Description of the Prior Art] With an electrodeposted tool, the abrasive grain made to adhere to the surroundings of axial material is buried around axial material with an electro-deposited metal, and it fixes. Although it is desirable for the piece piece to distribute independently by equal distribution density as for an abrasive grain, by the actual electrodeposted tool, two or more abrasive grains overlap like a dumpling, or there is also a part electrodeposited after the particle has appeared further on a particle. During a grinding process, a particle drops out, and these parts separate and cause the result which damages a processing ingredient. Severe processing quality comes to be required these days, and generating of the blemish by omission of an abrasive grain is no longer allowed.
[0003]
[Problem(s) to be Solved by the Invention] This invention was made in view of this problem, and uses as an offer plug the structure and its manufacture approach of the new electrodeposted tool by which an abrasive grain is distributed over a shaft material front face by the monolayer and the equal distributed consistency.
[0004]
[Means for Solving the Problem] The above-mentioned technical problem is solvable with the following means. Namely, the electrodeposted tool characterized by coming to carry out electrodeposted immobilization of this abrasive grain by the monolayer and

equal distribution density (number/mm of pieces 2) on this shaft material front face in the electrodeposted tool which consists of structure which the abrasive grain was made to adhere to the front face of ** tool shaft material, and carried out maintenance immobilization with the electro-deposited metal.

** The electrodeposted tool characterized by making an abrasive grain adhere to the front face of tool shaft material, having the depth of under the particle size of this abrasive grain in this shaft material front face, forming micropore with the aperture which can insert an abrasive grain piece by equal distribution density (number/mm of pieces 2) in the electrodeposted tool which consists of structure which carried out maintenance immobilization with the electro-deposited metal, inserting this abrasive grain in this micropore, and coming to carry out electrodeposted immobilization.

** The manufacture approach of the electrodeposted tool characterized by coming to have the process which covers the resist coat over which a detailed through tube with the aperture which can insert an abrasive grain piece is distributed by equal distribution density (number/mm of pieces 2) on the front face of tool shaft material, the process which inserts an abrasive grain in the micropore of this resist, and carries out temporary attachment with an electro-deposited metal, and the process which exfoliates this resist film and carries out electrodeposted immobilization of this abrasive grain.

[0005]

[Embodiment of the Invention] It is the description that distribute by distribution density that the abrasive grain of this invention electrodeposition tool has the independent particle of a piece piece and equal, and electrodeposted immobilization of the piece piece is carried out independently.

[0006] Drawing 1 -5 are a mimetic diagram explaining the decentralized structure of this invention abrasive grain. Drawing 1 -2 are a mimetic diagram explaining the structure which punches micropore and axial material is made to distribute. The distribution condition of micropore 2 is punched by regular pattern like drawing 2 . The magnitude of micropore 2 is the diameter which can insert an abrasive grain piece, and when an abrasive grain is inserted, it punches the depth to which the tip of an abrasive grain projects besides a hole, i.e., the depth of under particle size. Drawing 1 is drawing explaining this situation. An approach mechanical [laser, blasting, etching, etc.] and chemical can be suitably used for the means of punching. As long as the means of punching is a means which can punch the hole of the above-mentioned conditions, what kind of means is sufficient as it. Next, an abrasive grain is inserted in a hole, electrodeposition for seed attachment is performed, and temporary attachment of the abrasive grain is carried out. After temporary attachment, after washing or the brush removes excessive abrasive grains other than the abrasive grain inserted in the hole, electrodeposition for building-ups for fixing an abrasive grain is performed.

[0007] Drawing 3 -4 are a schematic diagram explaining how to insert an abrasive grain in the micropore which covered the resist film to axial material and was formed in this resist film. As first shown in drawing 3 , this approach covers the resist film 3 to the axial material 1, and punches the hole which inserts an abrasive grain in the resist film using approaches, such as laser or phot lithography. The magnitude of a hole is the diameter which can insert an abrasive grain piece as well as drawing 1 and the case of 2, and is the depth of under particle size. Next, an abrasive grain is inserted in a resist hole, electrodeposition for seed attachment is performed, and temporary attachment of the abrasive grain is carried out. A resist is removed after temporary attachment. Drawing 5 is drawing explaining the situation when removing a resist. Next, electrodeposition for building-ups for fixing an abrasive grain is performed.

[0008] Although the thickness of the electrodeposition for building-ups changes with applications, its thickness in which more than one half of the particle size of an abrasive grain is buried in general is desirable.

[0009] If 0.001-50 micrometers of electroless deposition film are covered on the front face of axial material and an abrasive grain, while a clearance will be lost and a touch area will become large between an abrasive grain and a building-up metal before building-up electrodeposition, by a plated metal's entering all over the concave convex of an abrasive grain, and discovering a powerful anchor effect, omission of an abrasive grain are lost and endurance improves sharply. nickel system, Co system, and Cu system are desirable, electroless deposition is divided and nickel-P and nickel-B system plating are suitable for it. In order for plating thickness to lose a clearance between an abrasive grain and a building-up metal, 0.001 micrometers or more of plating thickness are required. Moreover, if plating thickness exceeds an upper limit, it is not a crack may occur on the plating film and omitted during processing, and desirable.

[0010] A diamond, BN, SiC, WC and SiO2, graphite, SiN, SiC-Cu, SiC-aluminum, and all other abrasive grains can be used for an electrodeposted abrasive grain regardless of grain size.

[0011] Although nickel, cobalt, copper, an iron system metal, etc. can be suitably used for seed attachment and the electro-deposited metal for building-ups, a nickel system metal is the most desirable.

[0012]

[Example] Example 1 (diamond electrodeposition tool for CMP)

Axial material: SUS304 stainless steel and disc-like shaft material drawing 6 with a diameter of 120mm are the sectional views of axial material.

abrasive grain: -- grain size the distribution pattern shown in diamond abrasive grain drawing 7 of 100 meshes -- axial material -- the vertical 100x side of 50 micrometers, a depth of 50 micrometers, and a hole -- the hole which inserts an abrasive grain in the

THIS PAGE BLANK (USPTO)

distance of 50 micrometers of between was punched.
[0013] Cleaning, pickling, and after carrying out strike nickel plating, the diamond abrasive grain was put on A of axial material, and A' front face, and seed attachment plating of the axial material was carried out with the current density of 0.2 A/dm2 with nickel plating liquid of the following presentation for 120 minutes.
Presentation nickel-sulfate 240 g/l of seed attachment plating liquid, nickel chloride 40 g/l, boric-acid 40 g/l, PH4.2, 55 degrees C of bath temperature.
[0014] Next, the axial material which carried out seed attachment of the diamond abrasive grain was pulled up from plating liquid, it was failed with the harder brush to rub the abrasive grain which adhered in addition to the diamond which adhered too much, i.e., a concave hole, and the adhesion situation of a diamond was observed under the microscope. The diamond abrasive grain entered into all concave holes, and it was fixed by Electrodeposition nickel.
[0015] Next, building-up plating was carried out with the current density of 1 A/dm2 with the building-up plating liquid of the following presentation for 60 minutes, the building-up of the nickel was carried out to the surroundings of an abrasive grain, and about 80% of particle size was embedded.
Presentation nickel-sulfate 240 g/l of the electroplating liquid for building-ups, nickel chloride 45 g/l, boric-acid 40 g/l, stress reducer (world metal company make: zero oar) 20 ml/l, PH4.2, 55 degrees C [0016] of bath temperature It was used for polish of a silicon wafer with an evaluation test diameter of 8 inches, and the engine performance was evaluated. It has ground to homogeneity, without the abrasive grain having been omitted and a blemish occurring to 1000 sheets. The diamond abrasive grain was omitted in the place which carried out the polish test on the other hand using the same tool made from the conventional process, and 120 sheets, and the blemish occurred. It has checked that the tool of this invention had effectiveness remarkable in the generating prevention of a blemish and the improvement of endurance by abrasive grain omission.
[0017] Example 2 (diamond electrodeposition tool for CMP)
The same axial material as an example 1 was used.
Abrasive grain: The diamond abrasive grain of the same grain size (100 meshes) as an example 1 was used. 50 micrometers of photoresists were applied to the abrasive grain electrodeposition front face (A and A' side of drawing 6) of axial material, and only the part of the distribution pattern shown in drawing 7 punched the micropore (hole 100 x 50 micrometers, a depth of 50 micrometers, distance of 50 micrometers of between) penetrated to axial material by the approach of removing a resist.
[0018] The diamond abrasive grain was put on A and A' front face which applied the resist for the exposure front face of a resist and the axial material in micropore after carrying out strike nickel plating, cleaning, pickling, and, and seed attachment plating

THIS PAGE BLANK (USPTO)

was carried out with the current density of 0.2 A/dm2 with nickel plating liquid of the same presentation as an example 1 for 120 minutes.
[0019] Next, the axial material which carried out seed attachment of the diamond abrasive grain was pulled up from plating liquid, it was failed with the harder brush to rub the abrasive grain which adhered in addition to the diamond which adhered too much, i.e., a concave hole, the solvent removed the resist further, and the adhesion situation of a diamond was observed under the microscope. The abrasive grain of a piece piece was distributed by the distribution pattern shown in drawing 7 , and was being fixed by Electrodeposition nickel.
[0020] Next, building-up plating was carried out with the current density of 1 A/dm2 with the building-up plating liquid of the same presentation as an example 1 for 60 minutes, the building-up of the nickel was carried out to the surroundings of an abrasive grain, and about 80% was embedded.
[0021] It was used for polish of a silicon wafer with an evaluation test diameter of 8 inches, and the engine performance was evaluated. It has ground to homogeneity, without an abrasive grain being omitted to 1200 sheets. It has checked that the tool of this invention had higher efficacy in omission prevention of an abrasive grain and an improvement of endurance.
[0022] Example 3 (example which uses electroless deposition together)
Axial material and an abrasive grain are the same as an example 2. It carries out on the conditions same to seed attachment of an abrasive grain, and a resist exfoliation process as an example 2. By the well-known approach, cleaning, SENSHITAIZA, and after carrying out activator processing, 0.05-micrometer electroless deposition of nickel-P was carried out for the front face which the whole abrasive grain surface which carried out seed attachment, the axial material A, and A' side exposed using the electroless deposition liquid of the following presentation.
Presentation nickel sulfate of non-electrolyzed nickel-P plating liquid Building-up plating was carried out with the current density of 1 A/dm2 for 60 minutes with 20 g/l, sodium-citrate 30 g/l, specific hypophosphite 15 g/l, PH 8.9, and the building-up plating liquid of the presentation as an example 1 with next same 40 degrees C, the building-up of the nickel was carried out to the surroundings of an abrasive grain, and about 80% was embedded.
[0023] It was used for polish of a silicon wafer with an evaluation test diameter of 8 inches, and the engine performance was evaluated. It has ground to homogeneity, without an abrasive grain being omitted to 1500 sheets. It has checked that concomitant use of electroless deposition had remarkable effectiveness in omission prevention of an abrasive grain and an improvement of endurance.
[0024]

[Effect of the Invention] As a full account was given above, this invention has effectiveness remarkable in omission prevention of the abrasive grain of an electrodeposted tool, and makes a great contribution to the endurance of a tool, and improvement in processing quality.

[Translation done.]

THIS PAGE BLANK (USPTO)

TECHNICAL FIELD

[Field of the Invention] This invention relates to the structure and its manufacture approach of the electrodeposted tool by which an abrasive grain is distributed over the surroundings of tool shaft material by the monolayer and the equal distributed consistency.

[Translation done.]

* NOTICES *

PRIOR ART

[Description of the Prior Art] With an electrodeposted tool, the abrasive grain made to adhere to the surroundings of axial material is buried around axial material with an electro-deposited metal, and it fixes. Although it is desirable for the piece piece to distribute independently by equal distribution density as for an abrasive grain, by the actual electrodeposted tool, two or more abrasive grains overlap like a dumpling, or there is also a part electrodeposited after the particle has appeared further on a particle. During a grinding process, a particle drops out, and these parts separate and cause the result which damages a processing ingredient. Severe processing quality comes to be required these days, and generating of the blemish by omission of an abrasive grain is no longer allowed.

[Translation done.]

THIS PAGE BLANK (USPTO)

EFFECT OF THE INVENTION

[Effect of the Invention] As a full account was given above, this invention has effectiveness remarkable in omission prevention of the abrasive grain of an electrodeposted tool, and makes a great contribution to the endurance of a tool, and improvement in processing quality.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] This invention was made in view of this problem, and uses as an offer plug the structure and its manufacture approach of the new electrodeposted tool by which an abrasive grain is distributed over a shaft material front face by the monolayer and the equal distributed consistency.

[Translation done.]

MEANS

[Means for Solving the Problem] The above-mentioned technical problem is solvable with the following means. Namely, the electrodeposted tool characterized by coming to carry out electrodeposted immobilization of this abrasive grain by the monolayer and equal distribution density (number/mm of pieces 2) on this shaft material front face in the electrodeposted tool which consists of structure which the abrasive grain was made to adhere to the front face of ** tool shaft material, and carried out maintenance immobilization with the electro-deposited metal.
** The electrodeposted tool characterized by making an abrasive grain adhere to the front face of tool shaft material, having the depth of under the particle size of this abrasive grain in this shaft material front face, forming micropore with the aperture which can insert an abrasive grain piece by equal distribution density (number/mm of pieces 2) in the electrodeposted tool which consists of structure which carried out maintenance immobilization with the electro-deposited metal, inserting this abrasive grain in this micropore, and coming to carry out electrodeposted immobilization.
** The manufacture approach of the electrodeposted tool characterized by coming to have the process which covers the resist coat over which a detailed through tube with the aperture which can insert an abrasive grain piece is distributed by equal distribution density (number/mm of pieces 2) on the front face of tool shaft material, the process which inserts an abrasive grain in the micropore of this resist, and carries out temporary attachment with an electro-deposited metal, and the process which exfoliates this resist film and carries out electrodeposted immobilization of this abrasive grain.
[0005]
[Embodiment of the Invention] It is the description that distribute by distribution density that the abrasive grain of this invention electrodeposition tool has the independent particle of a piece piece and equal, and electrodeposted immobilization of the piece piece is carried out independently.

[0006] Drawing 1 -5 are a mimetic diagram explaining the decentralized structure of this invention abrasive grain. Drawing 1 -2 are a mimetic diagram explaining the structure which punches micropore and axial material is made to distribute. The distribution condition of micropore 2 is punched by regular pattern like drawing 2 . The magnitude of micropore 2 is the diameter which can insert an abrasive grain piece, and when an abrasive grain is inserted, it punches the depth to which the tip of an abrasive grain projects besides a hole, i.e., the depth of under particle size. Drawing 1 is drawing explaining this situation. An approach mechanical [laser, blasting, etching, etc.] and chemical can be suitably used for the means of punching. As long as the means of punching is a means which can punch the hole of the above-mentioned conditions, what kind of means is sufficient as it. Next, an abrasive grain is inserted in a hole, electrodeposition for seed attachment is performed, and temporary attachment of the abrasive grain is carried out. After temporary attachment, after washing or the brush removes excessive abrasive grains other than the abrasive grain inserted in the hole, electrodeposition for building-ups for fixing an abrasive grain is performed.
[0007] Drawing 3 -4 are a mimetic diagram explaining how to insert an abrasive grain in the micropore which covered the resist film to axial material and was formed in this resist film. As first shown in drawing 3 , this approach covers the resist film 3 to the axial material 1, and punches the hole which inserts an abrasive grain in the resist film using approaches, such as laser or phot lithography. The magnitude of a hole is the diameter which can insert an abrasive grain piece as well as drawing 1 and the case of 2, and is the depth of under particle size. Next, an abrasive grain is inserted in a resist hole, electrodeposition for seed attachment is performed, and temporary attachment of the abrasive grain is carried out. A resist is removed after temporary attachment. Drawing 5 is drawing explaining the situation when removing a resist. Next, electrodeposition for building-ups for fixing an abrasive grain is performed.
[0008] Although the thickness of the electrodeposition for building-ups changes with applications, its thickness in which more than one half of the particle size of an abrasive grain is buried in general is desirable.
[0009] If 0.001-50 micrometers of electroless deposition film are covered on the front face of axial material and an abrasive grain, while a clearance will be lost and a touch area will become large between an abrasive grain and a building-up metal before building-up electrodeposition, by a plated metal's entering all over the concave convex of an abrasive grain, and discovering a powerful anchor effect, omission of an abrasive grain are lost and endurance improves sharply. nickel system, Co system, and Cu system are desirable, electroless deposition is divided and nickel-P and nickel-B system plating are suitable for it. In order for plating thickness to lose a clearance between an abrasive grain and a building-up metal, 0.001 micrometers or more of plating thickness are

THIS PAGE BLANK (USPTO)

required. Moreover, if plating thickness exceeds an upper limit, it is not a crack may occur on the plating film and omitted during processing, and desirable.
[0010] A diamond, BN, SiC, WC and SiO2, graphite, SiN, SiC-Cu, SiC-aluminum, and all other abrasive grains can be used for an electrodeposted abrasive grain regardless of grain size.
[0011] Although nickel, cobalt, copper, an iron system metal, etc. can be suitably used for seed attachment and the electro-deposited metal for building-ups, a nickel system metal is the most desirable.

[Translation done.]

* NOTICES *

Japan Patent Office is not responsible for any damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

EXAMPLE

[Example] Example 1 (diamond electrodeposition tool for CMP)
Axial material: SUS304 stainless steel and disc-like shaft material drawing 6 with a diameter of 120mm are the sectional views of axial material.
abrasive grain: -- grain size the distribution pattern shown in diamond abrasive grain drawing 7 of 100 meshes -- axial material -- the vertical 100x side of 50 micrometers, a depth of 50 micrometers, and a hole -- the hole which inserts an abrasive grain in the distance of 50 micrometers of between was punched.
[0013] Cleaning, pickling, and after carrying out strike nickel plating, the diamond abrasive grain was put on A of axial material, and A' front face, and seed attachment plating of the axial material was carried out with the current density of 0.2 A/dm2 with nickel plating liquid of the following presentation for 120 minutes.
Presentation nickel-sulfate 240 g/l of seed attachment plating liquid, nickel chloride 40 g/l, boric-acid 40 g/l, PH4.2, 55 degrees C of bath temperature.
[0014] Next, the axial material which carried out seed attachment of the diamond abrasive grain was pulled up from plating liquid, it was failed with the harder brush to rub the abrasive grain which adhered in addition to the diamond which adhered too much, i.e., a concave hole, and the adhesion situation of a diamond was observed under the microscope. The diamond abrasive grain entered into all concave holes, and it was fixed by Electrodeposition nickel.
[0015] Next, building-up plating was carried out with the current density of 1 A/dm2 with the building-up plating liquid of the following presentation for 60 minutes, the building-up of the nickel was carried out to the surroundings of an abrasive grain, and about 80% of particle size was embedded.
Presentation nickel-sulfate 240 g/l of the electroplating liquid for building-ups, nickel chloride 45 g/l, boric-acid 40 g/l, stress reducer (world metal company make: zero oar) 20 ml/l, PH4.2, 55 degrees C [0016] of bath temperature It was used for polish of a silicon

wafer with an evaluation test diameter of 8 inches, and the engine performance was evaluated. It has ground to homogeneity, without the abrasive grain having been omitted and a blemish occurring to 1000 sheets. The diamond abrasive grain was omitted in the place which carried out the polish test on the other hand using the same tool made from the conventional process, and 120 sheets, and the blemish occurred. It has checked that the tool of this invention had effectiveness remarkable in the generating prevention of a blemish and the improvement of endurance by abrasive grain omission.
[0017] Example 2 (diamond electrodeposition tool for CMP)
The same axial material as an example 1 was used.
Abrasive grain: The diamond abrasive grain of the same grain size (100 meshes) as an example 1 was used. 50 micrometers of photoresists were applied to the abrasive grain electrodeposition front face (A and A' side of drawing 6) of axial material, and only the part of the distribution pattern shown in drawing 7 punched the micropore (hole 100 x 50 micrometers, a depth of 50 micrometers, distance of 50 micrometers of between) penetrated to axial material by the approach of removing a resist.
[0018] The diamond abrasive grain was put on A and A' front face which applied the resist for the exposure front face of a resist and the axial material in micropore after carrying out strike nickel plating, cleaning, pickling, and, and seed attachment plating was carried out with the current density of 0.2 A/dm2 with nickel plating liquid of the same presentation as an example 1 for 120 minutes.
[0019] Next, the axial material which carried out seed attachment of the diamond abrasive grain was pulled up from plating liquid, it was failed with the harder brush to rub the abrasive grain which adhered in addition to the diamond which adhered too much, i.e., a concave hole, the solvent removed the resist further, and the adhesion situation of a diamond was observed under the microscope. The abrasive grain of a piece piece was distributed by the distribution pattern shown in drawing 7 , and was being fixed by Electrodeposition nickel.
[0020] Next, building-up plating was carried out with the current density of 1 A/dm2 with the building-up plating liquid of the same presentation as an example 1 for 60 minutes, the building-up of the nickel was carried out to the surroundings of an abrasive grain, and about 80% was embedded.
[0021] It was used for polish of a silicon wafer with an evaluation test diameter of 8 inches, and the engine performance was evaluated. It has ground to homogeneity, without an abrasive grain being omitted to 1200 sheets. It has checked that the tool of this invention had higher efficacy in omission prevention of an abrasive grain and an improvement of endurance.
[0022] Example 3 (example which uses electroless deposition together)
Axial material and an abrasive grain are the same as an example 2. It carries out on the

conditions same to seed attachment of an abrasive grain, and a resist exfoliation process as an example 2. By the well-known approach, cleaning, SENSHITAIZA, and after carrying out activator processing, 0.05-micrometer electroless deposition of nickel-P was carried out for the front face which the whole abrasive grain surface which carried out seed attachment, the axial material A, and A' side exposed using the electroless deposition liquid of the following presentation.
Presentation nickel sulfate of non-electrolyzed nickel-P plating liquid Building-up plating was carried out with the current density of 1 A/dm2 for 60 minutes with 20 g/l, sodium-citrate 30 g/l, specific hypophosphite 15 g/l, PH 8.9, and the building-up plating liquid of the presentation as an example 1 with next same 40 degrees C, the building-up of the nickel was carried out to the surroundings of an abrasive grain, and about 80% was embedded.
[0023] It was used for polish of a silicon wafer with an evaluation test diameter of 8 inches, and the engine performance was evaluated. It has ground to homogeneity, without an abrasive grain being omitted to 1500 sheets. It has checked that concomitant use of electroless deposition had remarkable effectiveness in omission prevention of an abrasive grain and an improvement of endurance.

[Translation done.]

DESCRIPTION OF DRAWINGS

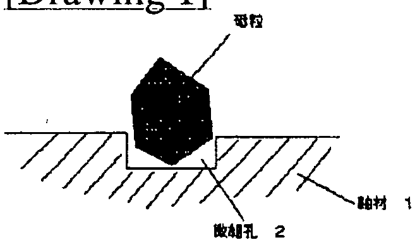
[Brief Description of the Drawings]
[Drawing 1] Drawing 1 is drawing explaining the structure of making micropore inserting and distributing the abrasive grain of this invention tool.
[Drawing 2] Drawing 2 is drawing explaining the distributed condition of drawing 1 .
[Drawing 3] Drawing 3 is the explanatory view of a resist hole.
[Drawing 4] Drawing 4 is an explanatory view in the condition of having inserted the abrasive grain in the hole of a resist.
[Drawing 5] Drawing 5 is an explanatory view in the condition of having removed the resist.
[Drawing 6] Drawing 6 is the sectional view of the axial material of an example.
[Drawing 7] Drawing 7 is the explanatory view of the distributed condition of the abrasive grain of an example.
[Description of Notations]
1 -- Axial material 2 -- Micropore
3 -- Resist film

[Translation done.]

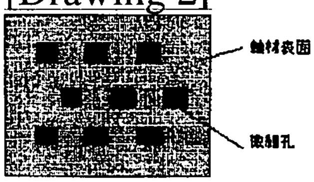
* NOTICES *

DRAWINGS

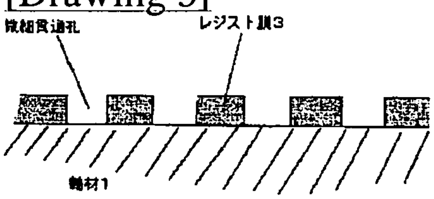
[Drawing 1]



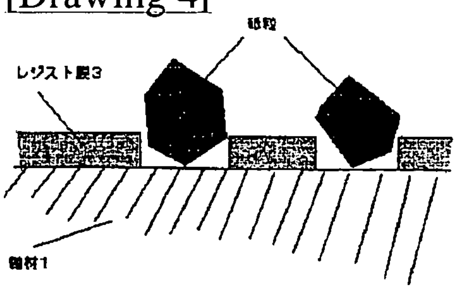
[Drawing 2]



[Drawing 3]

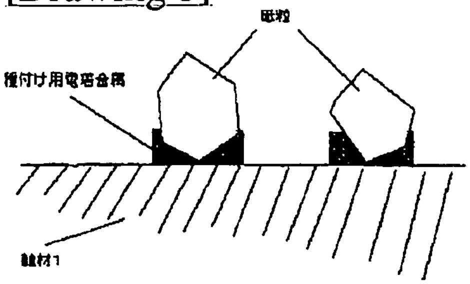


[Drawing 4]

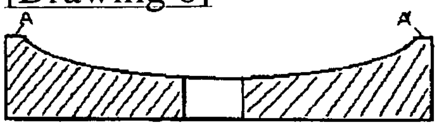


BEST AVAILABLE COPY

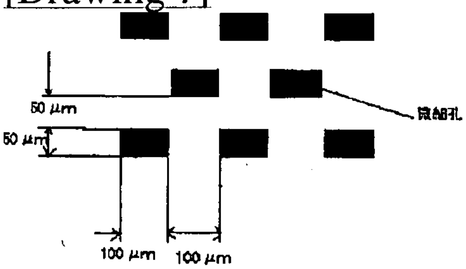
[Drawing 5]



[Drawing 6]



[Drawing 7]



[Translation done.]